

Rubin & Hays

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CHARLES S. MUSSON
W. RANDALL JONES
CHRISTIAN L. JUCKETT

PARALEGAL
MARY M. EMBRY

January 7, 2005

RECEIVED
JAN 10 2005
PUBLIC SERVICE
COMMISSION

Ms. Elizabeth O'Donnell
Executive Director
Public Service Commission
P.O. Box 615
Frankfort, Kentucky 40602

Case 2005-00023

Re: Green Hills Water District - Public Service Commission Application for the Water System Improvements Project

Dear Ms. O'Donnell:


Enclosed please find the original and ten (10) copies of the Application of the Green Hills Water District for a Certificate of Public Convenience and Necessity to construct a waterworks improvement project.

Also enclosed are eleven (11) copies of the required exhibits and two (2) copies of the Final Engineering Report. The Plans and Specifications, as prepared by Summit Engineering, are being forwarded by said Engineers.

If you need any additional information or documentation, please let us know.

Sincerely,

Rubin & Hays

By 
W. Randall Jones

WRJ:jl
Enclosures
cc: Distribution List

DISTRIBUTION LIST

**Re: Green Hills Water District Public Service Commission Application - Contract
1 Water Storage Tank**

Mr. Al Whitt, Chairman
Green Hills Water District
P.O. Box 116
Bledsoe, Kentucky 40810

Telephone: (606) 558-3995

Mr. Charlie Byers
Summit Engineering, Inc.
131 Summit Drive
Pikeville, Kentucky 41501

Telephone: (606) 432-1447
Fax: (606) 432-1440

W. Randall Jones, Esq.
Rubin & Hays
Kentucky Home Trust Building
450 South Third Street
Louisville, Kentucky 40202

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COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

RECEIVED
JAN 10 2005
PUBLIC SERVICE
COMMISSION

In the matter of:

APPLICATION OF THE GREEN HILLS)
WATER DISTRICT FOR A CERTIFICATE)
OF PUBLIC CONVENIENCE AND NECESSITY) Case No. 2005-00023
TO CONSTRUCT AN IMPROVEMENTS PROJECT)
PURSUANT TO KRS 278.020)

APPLICATION

The Green Hills Water District (the "District"), by counsel, pursuant to KRS 278.020, petitions the Commission for a certificate of public convenience and necessity to construct a waterworks improvement project. The following information is filed in accordance with the Commission's regulations:

1. The District's office address is P.O. Box 116, Bledsoe, Kentucky 40810. Its principal officers are listed in its current Annual Report, which is filed with the Commission;
2. The District is a non-profit water district organized under KRS Chapter 74 and has no separate articles of incorporation or by-laws;
3. A description of the District's water system and its property stated at original cost by accounts is contained in its Annual Report, which is incorporated by reference pursuant to 807 KAR 5:001 Section (5)(5). All required normal financial schedules and other data are in the Annual Report;
4. The water system expansion project consists of the construction and installation of a 100,000 gallon water storage tank and appurtenances, including approximately 420 linear feet of 6-inch water line.

5. The original project involved of 2 contracts consisting of contract 1 - the Green Hills School Tank; and contract 2 - the Little Shepherd's Trail Water Line Extensions. The project cost was estimated at \$860,477 and was to be funded entirely with coal severance grant monies. Due to circumstances beyond the District's control, a large portion of the coal severance grant money originally designated for this project was diverted to different project undertaken by another water district. Approximately \$446,000 of coal severance grant money was left for the District's use and it was decided that contract 1 would be bid and awarded because the existing 44,000 gallon water tank was undersized and in disrepair. Accordingly, the final project cost for contract 1 is approximately \$296,033.70, as set forth in the As Bid Project Budget contained in the Final Engineering Report filed herewith. There is approximately \$149,966.30 of the coal severance grant money remaining and the District is in the process of deciding how best to use this money in order to attain the most benefit for its customers;

6. The District has obtained all easements are required for the Project;

7. This service will not compete with any other utility in the area;

8. Based on these facts, the District believes that it is in the public interest that this certificate of public convenience and necessity be granted;

9. Copies of the certified bid tabulations are included in the Final Engineering Report filed herewith;

10. The following information is provided in response to 807 KAR 5:001 Section (8)(3);

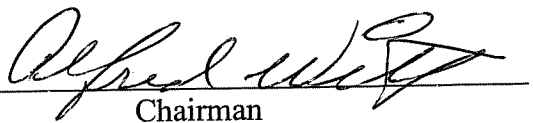
a. Articles of Incorporation - None, District is a statutorily created water district under KRS Chapter 74;

11. The following information is supplied to 807 KAR 5:001 Section (9)(2);

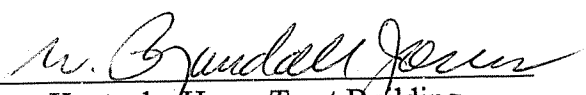
- a. Facts relied upon to show that the Project is in the public interest: the water storage tank will replace an existing tank that is undersized and in a state of disrepair.
- b. No new franchises are required. Copies of the permits are attached hereto as **Exhibit A**;
- c. Diagrams of the proposed construction and construction specifications are contained in the Plans and Specifications on file with the Commission;
- d. Three (3) maps of suitable scale showing location of the proposed facilities are filed with this Application;
- e. The construction costs will be funded entirely by coal severance grant monies;
- f. The estimated cost of operation of the system after construction is completed is attached hereto as **Exhibit B**;

WHEREFORE, the Applicant, Green Hills Water District requests that the Public Service Commission of Kentucky grant to the Applicant a Certificate of Public Convenience and Necessity permitting the Applicant to construct a water system improvement project.

Green Hills Water District

By 
Chairman


Rubin & Hays

By 
Kentucky Home Trust Building
450 South Third Street
Louisville, Kentucky 40202
(502) 569-7525

[illegible]

The undersigned, Al Whitt, being duly sworn, deposes and states that he is the Chairman of the Green Hills Water District, Applicant; that he has read the foregoing Application and has noted the contents thereof; that the same is true of his own knowledge, except as to matters which are therein stated on information or belief, and as to those matters, he believes same to be true.

IN TESTIMONY WHEREOF, witness the signature of the undersigned on this January 5, 2005.


Al Whitt, Chairman
Green Hills Water District

Subscribed and sworn to before me by Al Whitt, Chairman of the Green Hills Water District,
on this January 5, 2005.

My Commission expires 4-4-07

Notary Public, in and for said County and State



ERNIE FLETCHER
GOVERNOR

ENVIRONMENTAL AND PUBLIC PROTECTION CABINET

DEPARTMENT FOR ENVIRONMENTAL PROTECTION

DIVISION OF WATER

14 REILLY ROAD

FRANKFORT, KENTUCKY 40601-1190

www.kentucky.gov

October 15, 2004

LAJUANA S. WILCHER
SECRETARY

Green Hills Water District
Mr. Al Whitt, Chairman
P.O. Box 116
Blodsoe, KY 40810

RE: AgencyID#1720 APE20040002
DW # 0480341_04_002
Green Hills School Tank
Harlan County, KY

Dear Mr. Whitt:

We have reviewed the plans and specifications for the above referenced project. The plans include the construction of approximately 413 ft of 6-inch PVC waterline and a 100,000 gallon ground storage tank. This is to advise that plans and specifications for the above referenced project are APPROVED with respect to sanitary features of design, as of this date with the requirements contained in the attached construction permit.

If you have any questions concerning this project, please contact Scott Thomson at (502) 564-2225, extension 549.

Sincerely,

Thomas E. Skaggs
for Donna S. Marlin, Manager
Drinking Water Branch
Division of Water

DSM:JST

Enclosures

C: Summit Engineering, Inc.
Harlan County Health Department
PSC



Distribution-Major Construction

Green Hills Water District

Subject Item Inventory

Activity ID No.: APE20040001

Subject Item Inventory:

| ID | Designation | Description |
|----------|---------------------|---|
| AIOO1720 | | |
| PORT1 | waterline | Install 413 ft of 6-inch PVC waterline near the Green Hills School |
| STOR1 | ground storage tank | Construct a 100,000 gallon ground storage tank near the Green Hills School. |

Subject Item Groups:

| ID | Description | Components |
|-------|---|---|
| GACT1 | Construct a 100,000 gallon ground storage tank and install 413 ft of 6-inch PVC waterline near the Green Hills School | STOR1 Construct a 100,000 gallon ground storage tank near the Green Hills School. |
| | | PORT1 Install 413 ft of 6-inch PVC waterline near the Green Hills School |

KEY

ACTV = Activity

AREA = Area

EQPT = Equipment

PERS = Personnel

STOR = Storage

TRMT = Treatment

AIOO = Agency Interest

COMB = Combustion

MNPT = Monitoring Point

PORT = Transport

STRC = Structure

Distribution-Major Construction

Green Hills Water District
Facility Requirements

Activity ID No.: APE20040001

Page 1 of 15

GACT1 (Green Hills School tank) Construct a 100,000 gallon ground storage tank and install 413 ft of 6-inch PVC waterline near the Green Hill School:

Monitoring Requirements:

| Condition No. | Parameter | Condition |
|---------------|-----------|---|
| M-1 | Coliform | The presence or absence of total Coliform monitored by sampling and analysis as needed shall be determined for the new or relocated water line(s). Take samples at connection points to existing lines, at 1 mile intervals, and at dead ends without omitting any branch of the new or relocated water line. Sample bottles shall be clearly identified as "special" construction tests. [401 KAR 8:100 Section 1(7), 401 KAR 8:150 Section 4, Recommended Standards for Water Works 8.5.6] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination. |
| M-2 | Coliform | The presence or absence of total Coliform monitored by sampling and analysis as needed shall be determined for the new storage structure(s). With at least 1 sample taken at least 24 hours after the first construction complete sample(s), take 2 or more samples from the yard hydrant, the outlet piping from the storage structure, or a sample tap directly connected to the storage structure. Sample bottles shall be clearly identified as "special" construction tests. [Recommended Standards for Water Works 7.0.18, 401 KAR 8:150 Section 4] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination. |

Submittal/Action Requirements:

Coliform:

| Condition No. | Condition |
|---------------|---|
| S-1 | Coliform For new construction projects, the distribution system, using the most expedient method, shall submit Coliform test results to the Cabinet: Due immediately following disinfection and flushing. [401 KAR 8:150 Section 4(2)] |

Distribution-Major Construction
Green Hills Water District
Facility Requirements

Activity ID No.: APE20040001

Narrative Requirements:

| Condition No. | Condition |
|---------------|---|
| T-4 | During construction, a set of approved plans and specification shall be available at the job site at all times. All work shall be performed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 1(7)(a)] |

Distribution-Major Construction

Green Hills Water District
Facility Requirements

Activity ID No.: APE20040001

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Limitation Requirements:

| Condition No. | Parameter | Condition |
|---------------|-----------------------|---|
| L-7 | Distance | <p>When water lines and sewers cross,</p> <ol style="list-style-type: none">1) water lines shall be laid such that the bottom of the water line is a vertical Distance ≥ 18 in above the top of the sewer line,2) 1 full length of the water pipe shall be located so that both joints of the water pipe will be as far from the sewer as possible, and3) special structural support for the water and sewer pipes may be required. [Recommended Standards for Water Works 8.6.3] <p>This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.</p> |
| L-8 | Distance | <p>The open end of an air relief pipe from automatic valves shall be extended a Distance ≥ 1.0 ft above grade and provided with a screened, downward-facing elbow. The pipe from a manually operated valve shall be extended to the top of the pit. Use of manual air relief valves is recommended wherever possible. [Recommended Standards for Water Works 8.4.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.</p> |
| L-9 | Pressure | <p>Pipes shall not be installed unless all points of the distribution system remain designed for ground level Pressure ≥ 20 psi under all conditions of flow. [Recommended Standards for Water Works 8.1.1] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.</p> |
| L-10 | Pressure | <p>Pressure ≥ 30 psi must be available on the discharge side of all meters. [401 KAR 8:100 Section 4(2)] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.</p> |
| L-11 | Residual Disinfection | <p>New or relocated water lines shall be thoroughly disinfected (in accordance with AWWA Standard C651) upon completion of construction and before being placed into service. To disinfect the new or relocated lines use chlorine or chlorine compounds in such amounts as to produce an initial disinfectant concentration of at least 50 ppm and a Residual Disinfection ≥ 25 ppm at the end of 24 hours. Follow the line disinfection with thorough flushing and place the lines into service if, and only if, Coliform monitoring applicable to the line does not show the presence of Coliform.</p> <p>If Coliform is detected, repeat flushing of the line and Coliform monitoring. If Coliform is still detected, repeat disinfection and flushing as if the line has never been disinfected. Continue the described process until monitoring does not show the presence of Coliform. [401 KAR 8:150 Section 4(1), Recommended Standards for Water Works 8.5.6] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.</p> |
| L-12 | Velocity | <p>Each fire hydrant shall be sized so that Velocity ≥ 2.5 ft/sec can be achieved in the water main served by the hydrant during flushing. [Recommended Standards for Water Works 8.1.6.b, 401 KAR 8:100 Section 1(7)] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.</p> |

Distribution-Major Construction

Green Hills Water District
Facility Requirements

Activity ID No.: APE20040001

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Narrative Requirements:

Additional Limitations:

| Condition No. | Condition |
|---------------|--|
| T-6 | <p>Additional Limitations:</p> <p>No flushing device, blow-off, or air relief valve shall be directly connected to any sewer. Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances shall not be directly connected to any storm drain or sanitary sewer. Such chambers, pits or manholes shall be drained to absorptions pits underground or to the surface of the ground where they are not subject to flooding by surface water. [Recommended Standards for Water Works 8.1.6, Recommended Standards for Water Works 8.4.3]</p> |
| T-7 | <p>Additional Limitations:</p> <p>If water lines are installed or replaced in areas of organic contamination or in areas within 200 ft of underground or petroleum storage tanks, ductile iron or other nonpermeable materials shall be used in all portions of the water line installation or replacement. [401 KAR 8:100 Section 1(5)(d)6, Recommended Standards for Water Works 8.0.2]</p> |
| T-8 | <p>Additional Limitations:</p> <p>No water pipe shall pass through or come in contact with any part of a sewer manhole. [Recommended Standards for Water Works 8.6.6]</p> |
| T-9 | <p>Additional Limitations:</p> <p>If a fire sprinkler system is to be installed, a double check detector assembly approved for backflow prevention shall be utilized. The double check detector assembly of the system shall be accessible for testing. [401 KAR 8:100 Section 1(7)]</p> |
| T-10 | <p>Additional Limitations:</p> <p>If water lines cross a stream or wetland, the provisions in the attached Water Quality Certification shall apply. If you have any questions please contact John Dovak of the Water Quality Branch at (502) 564-2225, extension 485. [401 KAR 8:100 Section 1(7)]</p> |

Distribution-Major Construction

Green Hills Water District
Facility Requirements

Activity ID No.: APE20040001

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STOR1 (ground storage tank) Construct a 100,000 gallon ground storage tank near the Green Hills School.:

Limitation Requirements:

| Condition No. | Parameter | Condition |
|---------------|-----------|---|
| L-1 | Depth | High and low level Depth ≥ 30 ft apart should not be allowed in storage structures providing pressure to a distribution system. [Recommended Standards for Water Works 7.3.2] This requirement is applicable during the following months: All Year. Statistical basis: Maximum. |
| L-2 | Depth | Water Depth ≥ 50 percent of the total water depth should be above grade. [Recommended Standards for Water Works 7.0.2.b] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable. |
| L-3 | Distance | Sewers, drains, standing water and similar sources of possible contamination shall be a Distance ≥ 50 ft from ground-level storage structures. The only exception allowed is for gravity sewers. Gravity sewers are allowed within 50 ft of ground-level storage structures only if they are a) greater than 20 ft from all ground-level storage structures and b) constructed of water main pipe pressure tested in place to 50 psi without leakage. [Recommended Standards for Water Works 7.0.2.b] This requirement is applicable during the following months: All Year. Statistical basis: Minimum. |
| L-4 | Distance | To prevent excessive erosion of storage structure foundations, the overflow and main drain shall either a) discharge to concrete or other stable surfaces (splash pads) which extend a Distance ≥ 10 ft away from the base of the storage structure or b) discharge directly into a crushed stone pit that is at least 2' x 2' x 2' which is a Distance ≥ 10 ft away from the base of the storage structure. [401 KAR 8:100 Section 1(7)] This requirement is applicable during the following months: All Year. Statistical basis: Minimum. |
| L-5 | Height | Tanks shall have an overflow which is a) brought down to a Height ≥ 12 and ≤ 24 in above the ground surface, b) of sufficient diameter to permit waste of water in excess of the filling rate, c) open downward, d) screened with twenty-four mesh noncorrodible screen installed within the pipe at a location least susceptible to damage by vandalism, and e) located on the outside of the tank so that any discharge is visible. [Recommended Standards for Water Works 7.0.7] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable. |

Distribution-Major Construction

Green Hills Water District
Facility Requirements

Activity ID No.: APE20040001

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Narrative Requirements:

Additional Limitations:

| Condition No. | Condition |
|---------------|---|
| T-5 | <p>Additional Limitations: All storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing. [Recommended Standards for Water Works 7.0.13]</p> |
| T-6 | <p>Additional Limitations: Tanks shall be constructed with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports, and piping for inflow and outflow. For steel tanks, any pipes running through the roof or sidewall must be welded or properly gasketed. For concrete tanks, any pipes running through the roof or sidewall shall be connected to standard wall castings which were poured in place during the forming of the concrete and which should have seepage rings imbedded in the concrete. [Recommended Standards for Water Works 7.0.10]</p> |
| T-7 | <p>Additional Limitations: All finished water storage structures shall have suitable watertight roofs and sidewalls which exclude birds, animals, insects, and excessive dust. [Recommended Standards for Water Works 7.0.3, Recommended Standards for Water Works 7.0.10]</p> |
| T-8 | <p>Additional Limitations: The roof of each storage structure shall be well drained. Downspout pipes shall not enter or pass through storage structures. Parapets or similar structures which would tend to hold water and snow on a storage structure roof shall not be approved unless adequate waterproofing and drainage are provided. [Recommended Standards for Water Works 7.0.11]</p> |
| T-9 | <p>Additional Limitations: Storage structures shall be designed so they can be isolated from the distribution system and drained for cleaning or maintenance without necessitating loss of pressure in the distribution system. [Recommended Standards for Water Works 7.3.2, Recommended Standards for Water Works 7.0.5]</p> |
| T-10 | <p>Additional Limitations: Storage structure drains shall discharge to the ground surface at a drainage structure inlet or splash plate. [Recommended Standards for Water Works 7.3.2, Recommended Standards for Water Works 7.0.7]</p> |
| T-11 | <p>Additional Limitations: No drain on a storage structure may have a direct connection to a sewer or storm drain. [Recommended Standards for Water Works 7.0.5, Recommended Standards for Water Works 7.0.7, Recommended Standards for Water Works 7.3.2]</p> |

Distribution-Major Construction

Green Hills Water District
Facility Requirements

Activity ID No.: APE20040001

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Narrative Requirements:

Additional Limitations:

| Condition No. | Condition |
|---------------|--|
| T-19 | <p>Additional Limitations: Storage structures shall be vented. Overflows shall not be considered as vents. Open construction between the sidewall and roof is not permitted. Vents shall</p> <ul style="list-style-type: none">a) prevent the entrance of rainwater,b) exclude birds and animals, andc) exclude insects and dust (as much as compatible with effective venting). <p>Vents may use four-mesh noncorrodible screen. [Recommended Standards for Water Works 7.0.9]</p> |
| T-20 | <p>Additional Limitations: Adequate controls shall be provided to maintain levels in storage structures. The level controls shall be acceptable to the Division of Water. Level indicating devices should be provided at a central location. Overflow and low-level warnings or alarms should be located at places in the community where they will be under responsible surveillance 24 hrs a day. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.3.3]</p> |
| T-21 | <p>Additional Limitations: If storage structures have a catwalk over the water, the catwalk floor shall be solid with raised edges so that shoe scrapings and dirt will not fall into the water. [Recommended Standards for Water Works 7.0.14]</p> |
| T-22 | <p>Additional Limitations: The area around the storage structure shall be graded in a manner that will prevent surface water from standing within 50 ft of the storage structure. [Recommended Standards for Water Works 7.0.16]</p> |
| T-23 | <p>Additional Limitations: Proper protection shall be given to metal surfaces by</p> <ul style="list-style-type: none">a) paints or other protective coatings and/orb) cathodic protective devices. [Recommended Standards for Water Works 7.0.17] |
| T-24 | <p>Additional Limitations: If cathodic protection is utilized,</p> <ul style="list-style-type: none">a) competent technical personnel should design and install the protection andb) a maintenance contract should be provided. [Recommended Standards for Water Works 7.0.17] |
| T-25 | <p>Additional Limitations: If the interior of the storage structure is coated or lined, the coating or lining shall be of a type approved by the Division of Water for use in contact with potable water. [401 KAR 8:020 Section 2(19)]</p> |

Distribution-Major Construction

Green Hills Water District
Facility Requirements

Activity ID No.: APE20040001

Page 15 of 15

Narrative Requirements:

| Condition No. | Condition |
|---------------|--|
| T-28 | <p>If applicable, chlorination method 1 generally requires</p> <ul style="list-style-type: none">a) filling a storage structure to the overflow level with water providing a free chlorine Residual Disinfection ≥ 10 ppm andb) i) completely draining the storage facility and refilling orb) ii) otherwise reducing (in accordance with method 1) the free chlorine residual to a level appropriate for distribution. [Recommended Standards for Water Works 7.0.18] |
| T-29 | <p>If applicable, chlorination method 2 generally requires</p> <ul style="list-style-type: none">a) scrubbing or spraying the water-contact surfaces of a storage structure with a water solution having an available chlorine concentration = 200 ppm andb) purging of the strong chlorine solution and filling to the overflow level. [Recommended Standards for Water Works 7.0.18] |
| T-30 | <p>If applicable, chlorination method 3 generally requires</p> <ul style="list-style-type: none">a) filling a storage structure to approximately 5% of the total storage volume with water having an available chlorine concentration of 50 ppm,b) continued filling of the storage structure to the overflow level with normal potable water, andc) purging the storage structure so that various disinfection by-products do not reach water consumers. [Recommended Standards for Water Works 7.0.18, 401 KAR 8:100 Section 1(7)] |

**GREEN HILLS SCHOOL TANK PROJECT
OPERATING AND MAINTENANCE
COST ESTIMATE
12/21/04**

| ITEM | ANNUAL COST |
|--|--------------|
| Water Main (400 lf) (1mile/5280 lf) (\$500/mile/yr) USE \$500/yr | \$38 |
| Service Lines (0 lf) (1mile/5280 lf) (\$500/mile/yr) USE \$300/yr | \$0 |
| Water Tanks 1 100,000 Gallon Glass Lined Storage Tank Use \$5000 Maintenance Dive Every 10 years | \$500 |
| TOTAL ANNUAL O&M COSTS | \$538 |

| ITEM | ANNUAL REVENUE |
|---|-----------------|
| No Additional Customers will Be Added Therefore there is No Additional Revenue | \$ - |
| TOTAL ANNUAL REVENUE | \$ (538) |



LITTLE SHEPHERD’S TRAIL WATER LINE EXTENSION
FINAL ENGINEERING REPORT
CONTRACT NOS 1& 2
GREEN HILLS WATER DISTRICT
HARLAN COUNTY, KENTUCKY

RECEIVED
JAN 10 2009
PUBLIC SERVICE
COMMISSION

Introduction

This report is prepared as documentation for the award of contract number 1 and preparation for the bidding of contract 2 for the Little Shepherd’s Trail Water Line Extension. The contracts are part of an effort by Green Hills Water District to provide water service to the residents on Little Shepherd’s Trail.

The Little Shepherd’s Trail Water Line Extension consists of two contracts. These are:

| Contract | Description |
|-----------------|------------------------------------|
| 1 | Green Hills School Tank |
| 2 | Little Shepherd’s Trail Water Line |

History/Objective

Planning identified the residents on Little Shepherd’s Trail as lacking water service. It also outlined a means for providing additional water storage and improved operation over the planning area and period. This project represents the culmination of the 0 to 2 years of planning.

The primary goals of the project are:

1. The rehabilitation of the existing pump station at Bigelow and installation of a new 100,000 gallon water storage tank at Green Hills.
2. Improve operation and service of the existing system in the Green Hills School area.

3. The extension of Green Hills Water District's water distribution service to the communities Little Shepherd's Trail Waterline.

The intent of the Little Shepherd's Trail Water Line Extension is to provide residents living in the above referenced communities with public water service.

The existing 44,000 gallon water storage tank is currently in a state of disrepair. The tank is also under sized for the number of customers served. The project intends to add a larger tank to the project.

The project has been delayed several times since inception due to various issues. The project scope was changed several times in order to best spend the project funds. The funding on the project has been delayed several times and total funding is not forthcoming at this point. A line ban on the water district prevented the issuance of the Division of Water Permit several months. Also, several major items of work have been changed, including the water tank location, pump station to be rehabilitated and total length of pipe.

Plans and Approvals

Plans, specifications, construction permit applications, and supporting calculations were submitted to DOW for review in December of 2003. The DOW approval letters were issued on February 2, 2004 for the waterlines and tanks. Modifications have been made to the plans at the request of Green Hills Water District since the plans were approved. Plan approval for the Green Hills School Tank Project were issued on October 15, 2004.

Easements and Rights of Way

All property for this project except for the location of the tank is either owned by the Department of Transportation or the water district. Paul Caldwell, county magistrate, obtained an easement for the tank from the property owner, Harlan County School

District. The Department of Transportation has issued the encroachment permit for the road bore.

Project Funding

The total project cost is estimated at \$860,477.00. A total of \$446,000.00 in funding is available. Funding for the project may be summarized as follows:

| | |
|---------------------|---------------|
| KIA 20/20 | \$ 160,500.00 |
| State Appropriation | \$ 35,500.00 |
| State Appropriation | \$ 125,000.00 |
| State Appropriation | \$ 125,000.00 |
| TOTAL | \$ 446,000.00 |

Bidding

Contract 1 was advertised for bids on August 7, 2004. Bids were opened 12 days later on August 19, 2004. Advertisement of contract 2 has been postponed due to funding problems. The results of bidding are summarized in attached letter dated August 20, 2004 at the back of this report. Evidentiary materials of the bidding process (affidavits) have not been obtained from the newspaper at this time, but will be forwarded if requested. A copy of the advertisement is included.

Plan for Award

The rules for award are lowest base bid. Alternates and deducts are not considered for the lowest base bid.

The tank bids were within the project estimate and the funding is available for this portion of the project.

A decision was made to proceed with construction of the school tank. A summary of possibilities is included with this report.

Financial Viability

All funds are available for draw down on the project. The breakdown of the project finances is included at the end of this report.

Construction Schedule

Contract #1 has a 140 calendar day construction time. The bid hold period expires on December 17, 2004. It is a project goal to have the contracts awarded before this date and issue a Notice to Proceed dated no later than September 20, 2004. This would have contract completing construction on February 6, 2005.

LITTLE SHEPHERD'S TRAIL WATER STORAGE TANK
GREEN HILLS WATER DISTRICT
AS BID PROJECT BUDGET
12/17/04

FUNDING

| | | |
|----------------------|-----------|-------------------|
| COAL SEVERENCE | \$ | 160,500.00 |
| | \$ | 35,500.00 |
| | \$ | 125,000.00 |
| | \$ | 125,000.00 |
| TOTAL FUNDING | \$ | 446,000.00 |

EXPENSES

| | | |
|--|-----------|-------------------|
| CONSTRUCTION | \$ | 187,417.00 |
| CONTINGENCY | \$ | 18,741.70 |
| ENGINEERING DESIGN | \$ | 44,000.00 |
| INSPECTION and CONSTRUCTION ADMINISTRATION | \$ | 17,125.00 |
| LEGAL | \$ | 15,000.00 |
| RIGHT OF WAY | \$ | 10,000.00 |
| GEOTECHNICAL | \$ | 3,750.00 |
| TOTAL EXPENSES | \$ | 296,033.70 |

| | | |
|--------------------------------|-----------|-------------------|
| TOTAL SURPLUS / DEFICIT | \$ | 149,966.30 |
|--------------------------------|-----------|-------------------|

Notes

*Design services were rendered for a larger project estimated at \$800,000.00. The water district did not receive full funding and decided to proceed with the water storage tank rather than wait on the entire funding to be committed.



SUMMIT ENGINEERING INC.

SINCE 1977

August 20, 2004

Green Hills Water District
P.O. Box 116
Bledsoe, KY 40601

Re: Little Shepherd's Trail Waterline Extension - 100,000 Gallon Water Storage Tank Bid Tabulation

Ladies and Gentlemen:

Bids were opened on August 19, 2004 at 2:00 PM local time at the Green Hills Water District for the above referenced project. The following parties were in attendance:

PERSONNEL

Riley Sumner
Benny Turner
Ron Blevins
Charles Byers, P.E.

REPRESENTING

KY Glass Lined Tank Systems, Inc.
Green Hills Water District
Nally and Haydon, LLC
Summit Engineering, Inc.

A certified tabulation of the bids received is attached hereto as Exhibit "A". Complete copies of the bids for the project reading file are provided in the attached envelope labeled Exhibit "B".

Bids were received from the following companies: Kentucky Glass Lined Tank Systems, Inc. and Welding, Inc. The bids were as follows:

| | |
|---|--------------|
| Kentucky Glass Lined Tank Systems, Inc. | \$194,917.00 |
| Welding, Inc. | \$206,650.00 |

Math errors were found on the bid from Kentucky Glass Lined Tank Systems, Inc. and no math errors were found on the bid from Welding, Inc. Math errors are identified in Exhibit "A".

The apparent low bidder is Kentucky Glass Lined Tank Systems, Inc. There were two Addendums. All contractors had acknowledged these addenda.

EVALUATION OF LOW BIDDER

Experience

Kentucky Glass Lined Tank Systems, Inc. is based in Lexington, KY. Summit Engineering, Inc. has worked with Kentucky Glass Lined Tank Systems, Inc. on several projects. Kentucky Glass Lined Tank Systems, Inc. has completed several construction jobs of greater size than this project.

in a satisfactory manner. Summit Engineering, Inc. has worked with Kentucky Glass Lined Tank Systems, Inc. before and was satisfied with the work.

Let Bond

Kentucky Glass Lined Tank Systems, Inc. submitted a bid bond drawn on Ohio Casualty Insurance Company of Ohio in the amount of 10% of the bid amount.

Bidders Questionnaire

Kentucky Glass Lined Tank Systems, Inc. completed and signed the bidders' questionnaire. The Bidder's Certification was signed.

RECOMMENDATION & CLOSURE

Funding for the project is adequate to pay for the construction of the 100,000 gallon water storage tank plus 10% contingency. The base bid for the apparent low bidder is \$187,117.00.

If this award methodology meets with the approval of the Green Hills Water District, we would caution that the following items must be confirmed/resolved prior to construction contract award:

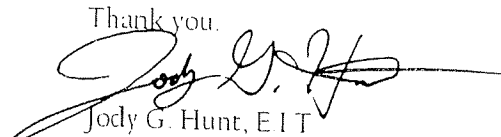
Confirm availability of funds.

Complete acquisition of project rights of way.

The contract documents provide for a 120 day bid hold. The last day to award the contract is December 17, 2004. The Contract documents require the Contractor to complete the work in 120 calendar days.

If you have any questions or if I can be of further assistance please feel free to contact me at our Pikeville, KY office at (606) 432-1447.

Thank you.


Jody G. Hunt, EIT
Project Engineer

encl

cc file



SUMMIT ENGINEERING INC.

\\Fileserver\Projects\02 Civil - Jody G Hunt\HARLAN\Little Sheaperd Water Line\Tank Contract recommendation\8-20-04bidtab let.doc

EXHIBIT A

GREEN HILLS WATER DISTRICT

Little Shepherd's Trail Waterline Extension - 100,000 Gallon Water Storage Tank

Bidder agrees to all the contract work described in the Specifications and shown on the Plans for the following unit prices.

| Item No | Item | TOTAL L | Unit | KY Glass Lined Tank Systems, Inc. | | Welding Inc. | |
|---------|---|------------|------|--------------------------------------|--------------|--------------|--------------|
| | | | | Unit Price | Amount | Unit Price | Amount |
| 1 | GENERAL | | | | | | |
| 1a | Mobilization/Demobilization | 1 | LS | \$ 1,000.00 | \$ 1,000.00 | \$ 4,000.00 | \$ 4,000.00 |
| 1b | Seeding | 1 | LS | \$ 1,000.00 | \$ 1,000.00 | \$ 2,000.00 | \$ 2,000.00 |
| 1c | Special Pipe Bedding | 20 | TON | \$ 20.00 | \$ 400.00 | \$ 20.00 | \$ 400.00 |
| 2 | CONNECTIONS | | | | | | |
| 2a | Tap Existing Water Line | 1 | EA | \$ 2,750.00 | \$ 2,750.00 | \$ 1,000.00 | \$ 1,000.00 |
| 3 | WATER LINE | | | | | | |
| 3b | 6" PVC Water Line, SDR 17 | 420 | LF | \$ 16.00 | \$ 6,720.00 | \$ 25.00 | \$ 10,500.00 |
| 4 | VALVES | | | | | | |
| 4a | 6" Resilient Wedge Gate Valve MJ - 250 psi | 3 | EA | \$ 800.00 | \$ 2,400.00 | \$ 800.00 | \$ 2,400.00 |
| 5 | FITTINGS | | | | | | |
| 5a | 6"x6"x6" Compact DI Tee, MJ | 1 | EA | \$ 320.00 | \$ 320.00 | \$ 400.00 | \$ 400.00 |
| 6 | ENCASEMENTS | | | | | | |
| 6a | Bore and Encase for 6" Water Line | 75 | LF | \$ 60.00 | \$ 4,500.00 | \$ 130.00 | \$ 9,750.00 |
| 8 | HYDRANTS | | | | | | |
| 8a | Blow Off | 1 | EA | \$ 3,000.00 | \$ 3,000.00 | \$ 1,200.00 | \$ 1,200.00 |
| 10 | MISCELLANEOUS | | | | | | |
| 10 | 100,000 Gallon Water Storage Tank (includes valve pit) | | | | | | |
| 10a | Alternate (a) AWWA D-103 Factory Glass Coated Bolted Steel Tank | 1 | LS | \$165,327.00 | \$165,327.00 | | |
| 10b | Alternate (b) AWWA D-100 Welded Steel Tank | 1 | LS | | | \$175,000.00 | \$175,000.00 |
| | GRAND TOTAL | | | | \$187,417.00 | | \$206,650.00 |

NOTES

1. The method of payment varies with the individual item and is described at the close of each section of the Technical Specification.
2. The amount for Mobilization/Demobilization may not exceed 3% of the Base Bid Total.
3. Budgeted cost only. Payment shall be ACTUAL documented costs plus 10 percent. (See Specifications)

Alternate Bid Items

Summary:

Kentucky Glass Lined Tank Systems, Inc. is the apparent low bidder. Kentucky Glass Lined Tank Systems, Inc. base bid becomes \$187,417.00 instead of \$194,917.00 because unit prices govern.

ERRORS

INCORRECT BID SHEET
ITEM 6a BID AS \$12,000.00
SHOULD BE \$4,500.00
BID WAS TOTALLED
INCORRECTLY

NO ERRORS

mobile home. Local
ad. past hospital.
\$275.00 a month.
Hud App. Call 573-
9728 or 573-8760

FOR SALE: 2002,
14'x40' Glas Trailer,
1 bdrm, 1 bath, cen-
tral AC, porch, un-
derpinned. Located
in Kildav, must be
moved. Call 837-
3607

770 Real
Estate
Wanted

WANT TO TRADE:
Large 3 bdrm house
in Cumberland for a
small 2 bdrm house
in Harlan area. Call
589-5211

800 Automobiles
for Sale

FOR SALE: 92' Mit-
subishi 3000 GT,
SL, Black \$6,000
Call 573-1376

FOR SALE: 97'
Mustang Converti-
ble, Black, V6, Auto-
matic, 113,000
miles, \$4,500 Call
573-5527

830 Motorcycles,
ATV's

FOR SALE: 1999
Honda XR80R Dirt
Bike, \$1,000, Honda
125 4trax 4-wheeler
\$1,000, both in great
condition. Call 837-
2341

FOR SALE: 2003
Polaris Ranger 6x6
w/body top and wind
shield, \$8,800 call
873-8367

850 Auto Parts &
Accessories

F & K Auto Parts
Rebuilt starters and
alternators. Foreign
or domestic cars
and trucks. Stands
for outdoor mowers
and lawn mowers.
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EXPERIENCED MECHANIC FOR BUSY
Medium - Heavy Duty Truck
Dealership in Middlesboro, KY
Candidate must have experience and be
available for ongoing training. Salary based
on experience, including benefits package.
Apply at
Worldwide Equipment,
Maack Avenue Industrial Park
Or call 606.248.5100 for appointment.
Equal Opportunity Employer

United Technical Services of Kentucky
is seeking qualified

Computer Consultants
And DirecTV/DirecWay
Installers

In the tri-state area. Call Mark Ashby for
more information at 1-800-310-4425

R.N. & L.P.N.
POSITIONS

*Do you want to make a
difference in someone's life?*
HERE'S HOW!

Become a member of a team
devoted to providing quality care in
a friendly work environment

FULL TIME & PRN POSITIONS
AVAILABLE

Revised Pay Scale
Shift Differential
401-K Benefits

Excellent Vacation and Sick Benefits
Health and Life Insurance
CEU Reimbursement

**"New Graduates Encouraged
To Apply"**

Please apply in person or fax
resume to:

Harlan
Nursing Home

74 Comprehensive Drive

P.O. Box 895

Harlan, Kentucky 40831

Phone: (606) 573-7250

Fax: (606) 573-6734

E.O.E.

001 Public Notices

SECTION ONE
ADVERTISEMENT FOR BID

Little Shepherd's Trail Waterline Extension —
100,000 Gallon Storage Tank

Sealed proposals for the Little Shepherd's Trail Waterline
Extension — 100,000 Gallon Storage Tank will be received on
behalf of the Green Hills Water District at the Green Hills Water
District Offices in Bledsoe, KY 40801. The deadline for the
submittal of sealed proposals is August 19, 2004 at 2:00 pm local
time. Immediately following the closing time for the reception of
all bids, all proposals that have been submitted in accordance
with the Contract Documents will be publicly opened and read.
The Contract Documents are available for examination at the
following locations:

Green Hills Water District
P.O. Box 118
Bledsoe, KY 40801

The Contract Documents may be obtained from:
Summit Engineering, Inc.
131 Summit Drive
Pikeville, KY 41501

from 8:00 A.M. until 5:00 p.m. Monday through Friday at a non-
refundable cost of \$75.00 for each set of documents plus a
\$10.00 handling fee for documents which must be mailed.
Payment must be by company check/cashier's check. NO CASH,
NO PERSONAL CHECKS ACCEPTED. Checks for Contract
Documents shall be payable to Summit Engineering, Inc.

The Owner and Engineer shall not be responsible for any full or
partial sets of Contract Documents obtained from any other
source. No bid will be considered unless submitted on the Bid
Form provided with the Contract Documents.

Each bid must be accompanied by a Bid Bond, payable to the
Green Hills Water District, in an amount of no less than 10% of
the bid. Certified checks are acceptable as bond. Should any Bid
be rejected, the Bid Security will be returned to the Bidder.

No Bid may be withdrawn after the Scheduled Time for Receipt of
Bids for at least one hundred twenty (120) days to allow review of
Bids before announcing tentative award of Contract. The Bid
security of the Successful Bidder will be retained until such
Bidder has executed the Agreement and furnished the contract
security, where upon the Bid security will be returned. The owner
reserves the right to reject any and all bids or so to let a contract
in whole or in part and to waive formalities.

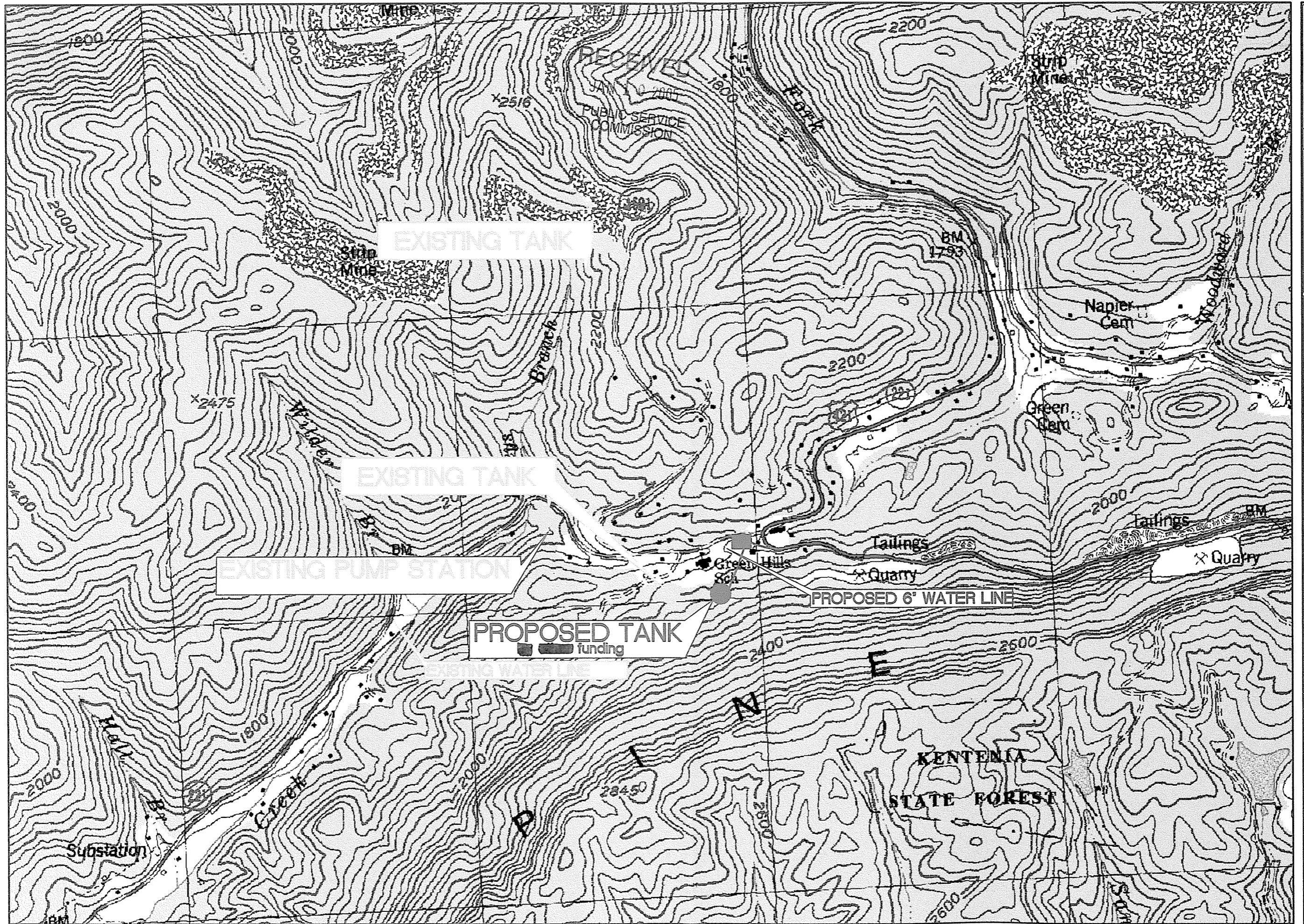
Work consists in part of the following:
Construction of 100,000 gallon water storage tank and valve pit
with connection to existing line.


It is strongly advised that anyone interested in bidding this project
should visit the site to inform him or herself of the work to be
accomplished. A pre-bid meeting will be conducted by
representatives of Summit Engineering, Inc. Interested
contractors are to meet at the offices of the Green Hills Water
District at 10:00 am local time on August 11, 2004.

The contract will be awarded based upon: (A) Bid price; (B)
Contractor's availability of labor, equipment and materials; (C)
Contractor's ability to perform the work; and (D) Contractor's
ability to perform the work in the allotted time frame.

Federal, State and local provisions do not apply to this project.
State wage and hour provisions do not apply to this project.
The Successful Bidder will be required to furnish Performance
and Payment Bonds each in an amount equal to the Contract
price.

The Owner reserves the right to reject any and all bids or to let a
contract in whole or in part and to waive formalities.



| SUMMIT ENGINEERING, INC. | | GREEN HILLS WATER TANK | | DESCRIPTION OF REVISION | |
|--|--|-------------------------------------|--|-------------------------|-------------------------|
|  SUMMIT ENGINEERING, INC. 1000 N. KY 100 PIKEVILLE, KY 40360 KY 1000 KY 1000 KY 1000 KY 1000 | | P.O. Box 116 Pikeville, KY 40360 | | DATE | DESCRIPTION OF REVISION |
| | | Green Hills School Tank | | | |
| | | | | | |
| | | | | | |
| DATE: 12/21/04 | | | | | |
| SCALE: 1" = 1000' | | | | | |
| DRAWN BY: C. Schneider | | | | | |
| CHECKED: K. Howard | | | | | |
| SHEET: | | | | | |
| OF: | | | | | |

**SUMMIT ENGINEERING INC.**

131 Summit Drive, Pikeville, Kentucky 41501 • 606-432-1447

LETTER OF TRANSMITTAL

| | | | |
|-----------|---------------------|---------|--|
| DATE | 1/7/06 | JOB NO. | |
| ATTENTION | ELIZABETH O'DONNELL | | |
| RE | GREEN HILLS | | |
| | SCHOOL TANK | | |
| | | | |
| | | | |
| | | | |

To KY PSC
P.O. BOX 615
FRANKFORT, KY 40602-615

WE ARE SENDING YOU

- ☐ Attached
☐ Under separate cover via _____

THE FOLLOWING ITEMS:

- | | | | |
|---|---------------------------------------|--|--|
| <input type="checkbox"/> Copy of Letter | <input type="checkbox"/> Prints | <input type="checkbox"/> Check No. _____ | <input type="checkbox"/> Contract Documents |
| <input type="checkbox"/> Samples | <input type="checkbox"/> Change order | <input type="checkbox"/> Specifications | <input type="checkbox"/> Preliminary Application |
| <input type="checkbox"/> Permit Application Package | <input type="checkbox"/> Plans | <input type="checkbox"/> Bond No. _____ | <input type="checkbox"/> Other _____ |

☒ **ACKNOWLEDGEMENT OF RECEIPT REQUESTED**

RECEIVED BY: _____ DATE _____

| COPIES | DATE | NO. | DESCRIPTION |
|--------|------|-----|--------------------------|
| 2 | | | APPROVED PLANS |
| 2 | | | APPROVED SPECIFICATIONS. |
| | | | |
| | | | |
| | | | |
| | | | |

THESE ARE TRANSMITTED as checked below:

- | | | |
|---|---|---|
| <input type="checkbox"/> For approval | <input type="checkbox"/> Approved as submitted | <input type="checkbox"/> Resubmit _____ copies for approval |
| <input type="checkbox"/> For your use | <input type="checkbox"/> Approved as noted | <input type="checkbox"/> Submit _____ copies for distribution |
| <input type="checkbox"/> As requested | <input type="checkbox"/> Returned for corrections | <input type="checkbox"/> Return _____ copies corrected prints |
| <input type="checkbox"/> For review and comment | <input type="checkbox"/> _____ | |
| <input type="checkbox"/> For bids due _____, 20 _____ | <input type="checkbox"/> prints returned after loaned to us | |

REMARKS M.S. O'DONNELL
IF YOU NEED ANYTHING
FURTHER PLEASE LET
ME KNOW.
THANKS
CHARLES BYERS

COPIES TO _____ SIGNED: 

SECTION IX
TECHNICAL SPECIFICATIONS
WATER LINES AND FITTINGS

RECEIVED

JAN 10 2005

PUBLIC SERVICE
COMMISSION**9.1 SCOPE**

This work shall consist of furnishing, installing, testing, and disinfecting potable water line pipes of various diameters.

9.1.1. Quality Assurance/Submittals

9.1.1.1 Submit five copies of documentation to substantiate pipe material's compliance with these specifications.

9.1.1.2 Submit five copies of CONTRACTOR'S Bedding and Backfilling Plan. At a minimum the plan shall:

- a. Identify/acknowledge the segments of pipe line to be backfilled using "open", "gravel", and "paved" criteria,
- b. Include a representative Proctor Curve for the backfill material for all significant sections of pipe line to be backfilled using "paved" criteria (curve to be prepared and sealed by a geotechnical engineer registered in the State of Kentucky - curve not required if CONTRACTOR backfills entire trench with fine crushed stone),
- c. Include quarry's material certification for all aggregates utilized for bedding, haunching, and initial protective backfill, and
- d. Include name and qualifications of CONTRACTOR'S nuclear density technician (technician must be a full time employee of CONTRACTOR, spot checks by a sub-contracting testing firm are not acceptable).

9.1.1.3 Submit five copies of each pressure test performed within 48 hours of test completion. Documentation to include quantity of water used and pressure charts from recording pressure gage.

9.1.1.4 Submit five copies of documentation for each disinfection of each pipe reach within 7 days of collection of samples. Documentation to include form of chlorine applied, method of application, quantity of make-up water used, quantity of residual chlorine concentration one hour after dosing, residual chlorine concentration 24 hours after dosing, point of disposal of waters of chlorination, method of de-chlorination, quantity of flushing water supplied, and results of bacteriological examination of water samples.

9.2 MATERIALS

9.2.1 General: All pipe used for potable water service shall be as indicated in the plans.

9.2.2 Ductile Iron Pipe, Fittings and Joints: Ductile iron pipe shall conform to the latest AWWA Specifications C151 (ANSI A21-51) with standard thickness as designated in AWWA C150. Thickness class shall be 350 unless noted otherwise on the plans by the ENGINEER.

The interior of the pipe shall be cement-mortar lined with bituminous seal coat in accordance with AWWA C104 (ANSI A21.4). Thickness of the lining shall be as set forth in Sec. 4-10-1 of the aforementioned specifications unless otherwise directed by the OWNER. The exterior of all pipe, unless otherwise specified, shall receive either a coal tar or asphalt base coating a minimum of one mil thick.

Where ductile iron pipe is to be installed in corrosive soil conditions, the pipe shall be protected by an eight mil thick polyethylene encasement meeting the requirements of ANSI A21.5. Such corrosive soils include but are not limited to salt marshes, saturated alkaline soils, cinder fills, areas of decaying vegetation, and waste dumps.

Bends and fittings shall be Mechanical Joint Compact Ductile Iron fittings, conforming to AWWA Specifications C153 for short body iron fittings. Fittings shall be tar-coated outside and shall receive the standard cement lining with bituminous seal coat on the inside as specified for the ductile iron pipe.

Joints shall be of the push-on (AWWA C111), mechanical joint (AWWA C111), restrained mechanical joint, flanged (AWWA C115) or ball and socket type as called for in the Plans. Bells for push-on type joints shall have an annular recess in the pipe socket to accommodate a single rubber gasket. Plain ends shall be suitably beveled to permit easy entry into the bell. The gasket is locked in place against displacement as the joint is assembled.

Mechanical joints shall be bolted and of the stuffing box type and shall consist of a bell with exterior flange and interior recess for the sealing gasket, a pipe or fitting plain end, a sealing gasket, a follower gland, tee-head bolts and hexagon nuts. A restrained mechanical joint is a mechanical joint with a ductile iron retainer gland equal to a Clow F-1058 retainer gland.

Joints for all bends and fittings for buried service shall be restrained mechanical joint type only (AWWA C111). Flanged joint pipe shall be used in vaults, pits and above ground service installation. Flanged joint pipe may not be used for buried service.

9.2.3 Polyvinyl Chloride Pipe, Fittings and Joints: PVC water pipe shall conform, at a minimum, to ASTM Specifications D-2241, and shall be pressure class 250. The pipe furnished under ASTM A-2241 shall have a standard dimension ratio not to exceed SDR 17, and shall be rated to a working pressure of at least 250 psi at 73.4°F.

Fittings shall be cast iron Mechanical Joint Class 250 conforming to AWWA Specifications C110 for short body cast iron fittings. Fittings shall be tar-coated outside, and shall receive the standard cement lining with bituminous seal coat on the inside as specified for the ductile iron pipe.

Joints shall be of the push-on type conforming to ASTM D3139 and F477 requirements for elastometric-gasket joints. All jointing material and lubricants shall be non-toxic.

9.2.3 Pipe Bedding: Pipe bedding stone shall be durable crushed limestone meeting the requirements of Section 805 of the Current Edition of the Kentucky Department of Highways publication "Standard Specifications for Road and Bridge Construction."

9.2.4 Geotextile Type III: Geotextiles shall be woven or non-woven geotextile fabrics meeting the material and strength requirements for Type III fabrics as set forth in Section 215 of the Current Edition of the Kentucky Department of Highways publication "Standard Specifications for Road and Bridge Construction."

9.3 INSTALLATION

9.3.1 Trench Excavation: Unless specifically directed otherwise by the ENGINEER, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any crew and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.

Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the approved plans. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches. Where rock is encountered, it shall be removed to a minimum depth of four inches below the pipe bells.

Unless specifically authorized by the ENGINEER, trenches shall in no case be excavated or permitted to become wider than two feet six inches plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than two feet six inches at the level of or below the top of the pipe, special precautions may be necessary, such as providing compacted granular fill up to the top of the pipe or providing pipe with additional crushing strength as determined by the ENGINEER. This determination shall take into account the actual trench loads that may result and the strength of the pipe being used.

All excavated materials shall be placed a minimum of two feet back from the edge of the trench.

Where conditions exist that may be conducive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed (See Section 9.3.1.2) to provide safe working conditions and to prevent damage of work.

Trenches shall be kept free of water during the laying of pipe and until the pipeline has been backfilled.

9.3.1.1 Obstructions: In cases where storm sewers, gas lines, water lines, telephone lines, and other utilities, or other underground structures are encountered, they shall not be displaced or molested unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible.

The CONTRACTOR shall notify the utility companies 48 hours prior to excavation adjacent to their facilities.

9.3.1.2 Shoring, Sheeting and Bracing: Where unstable material is encountered or where the depth of excavation in earth exceeds six feet, the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constructed areas unless otherwise specified. The design and installation of all sheetings, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the CONTRACTOR; however, the ENGINEER may require the submission of shoring plans (accompanied by the supporting computations) for review prior to the CONTRACTOR undertaking any portion of the work.

Foundations adjacent to where the excavation is to be made below the depth of existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation, and the CONTRACTOR shall be held strictly responsible for any damage to said foundation.

Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable wales and braces.

Care shall be taken to avoid excessive backfill loads on the completed pipelines, and the requirements that the width of the ditch at the level of the crown of the pipe be not more than two feet six inches plus the nominal diameters of the pipe shall, as set out in Section 9.3 hereinbefore, be strictly observed.

Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as necessary.

9.3.1.3 Blasting: Blasting operations on this project are prohibited.

9.3.2 Pipe Bedding: In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and insofar as possible where bell and spigot pipe are involved so that none of the load will be carried on the bells.

Where undercutting and granular bedding are involved, the depth at the bottom of the bells of the pipe will be at least four inches above the bottom of the trench as excavated.

Supporting of pipe shall be as set out hereinbefore, and in no case shall the supporting of pipe on blocks be permitted. The Design Drawings present typical approved bedding methods.

SECTION XVII

TECHNICAL SPECIFICATIONS

100,000 GALLON WATER STORAGE TANK RELOCATION

17.1 SCOPE

This work shall consist of furnishing all labor and materials necessary for proper dismantling, transport and reinstallation of an existing 100,000 gallon potable water storage tank. This includes:

- 1) Site excavation, backfill, and spoil disposal.
- 2) Valve vault, supply line (vault to tank), and overflow line
- 3) Access road construction including a suitable traveling surface.
- 4) Geotechnical report will be conducted if alternate selected. Concrete foundation slab for tank support.
- 5) Erection, disinfection and connection of 100,000 gallon storage tank at new location. complete with valve pit and accessories.
- 6) Tank test fill and disinfection.
- 7) 120 Volt AC power to valve vault.
- 8) Regrading, seeding and site cleanup.

17.2 SUBMITTALS

17.2.1 Submit six (6) complete sets of construction drawings and specifications for all work not shown in complete detail on the bidding drawings including detailed drawings of the foundation (skids). The drawings shall show the thickness of the plate and other data in connection with the work.

17.2.2 Submit five (5) copies of the contractors plan for dismantling and transport of tank to new Little Shepherd's Trail Storage Tank Site.(see sheet T-1)

17.2.3 Submit five (5) copies of CONTRACTOR'S guarantee. CONTRACTOR shall guarantee against defective workmanship for a period of one year from the date of completion. Any faulty workmanship found within one (1) year shall be repaired by the CONTRACTOR.

17.2.4 Submit five (5) copies of the documentation of test fill and disinfection. Documentation to include leaks repaired, quantity of test waters applied, chlorine concentrations achieved, method of dechlorination, point of disposal of waters of chlorination, and results of bacteriological examination of water samples.

17.2.5 Submit five (5) copies of proposed interior and exterior painting plan, complete with material safety data sheets, and documentation that paint systems meet the requirements of AWWA D-102, NSF 64, and the Kentucky Division of Water.

17.3 MATERIALS

17.3.1 Storage Tank Quality: Existing storage tank shall be dismantled and transported to new site. Tank shall be cleaned prior to filling. Also prior to filling areas requiring sanding and painting in order to meet AWWA specifications shall be corrected. Owner intends for all minor damage to be repaired on the tank prior to placing the tank in service.

17.3.2 Storage Tank Protective Coatings: The interior and exterior of the tank shall be painted in accordance with AWWA Standard D102 - Standard for Painting and Repainting Steel Tanks, Standpipes, Reservoirs, and Elevated Tanks for Water Storage - latest revision (Systems OCS-2-S and ICS-2-W) on all areas deemed necessary after transport and erection. All paint that is used in contact with finished water must be approved by AWWA, NSF 64, and the Kentucky Department of Natural Resources and Environmental Protection, Division of Water. CONTRACTOR shall submit proposed paint systems for approval in accordance with the submittals requirements of this specification.

17.3.3 Accessories: The water tank shall be provided with the following accessories:

- 1) Valve Pit: The valve pit shall include:
 - a) Pre-Cast concrete manhole ASTM C-478, internal diameter of 5' 0",
 - b) Flat slab manhole top with 3'x3' aluminum access hatch (Bilco Type K4, or equal),
 - c) AWWA C509 flanged joint gate valves of the size indicated in the Drawings with hand wheel operators,
 - d) Flanged joint, ductile iron tee of the size indicated in the Drawings,

e) Flanged joint ductile iron pipe to plumb the pit and push joint ductile iron pipe for the overflow drain,

f) Flap gate for overflow discharge.7) Frost Box: The CONTRACTOR shall provide a frost box to contain the exposed inlet/outlet pipe. The frost box shall extend six inches below the ground. It will be constructed of 1/4 inch steel with a hinged lid and painted the same as the tank. The frost box shall be made so that no leakage of water within the frost box will occur. The frost box will be completely filled with blown insulation.

2) Tank Access: The access road to the tank shall be constructed as detailed in the Drawings. The CONTRACTOR shall grade the roadway, construct ditches to provide positive drainage, and construct a driving surface for track vehicles.

3) Foundation Slab: Provide reinforced concrete foundation as determined by the Geotechnical report.

17.4 TESTING - HYDROSTATIC

17.4.1 Following tank installation and backfilling, the tank shall be cleaned. The tank shall then be tested for liquid tightness by filling to its overflow elevation.

17.4.2 Any leaks disclosed by this test shall be corrected by the CONTRACTOR in accordance with the manufacturer's recommendations at no additional cost to the OWNER.

17.4.3 All test and flushing waters shall be potable water obtained from the OWNER'S water distribution system. Withdrawals of water from the OWNER'S system must be both authorized and metered. The OWNER will bill the CONTRACTOR for all waters used in accordance with its current rate schedule.

17.4.4 Water from the hydrostatic test fill may be subsequently employed for disinfection. If the water from the test fill is not used in this manner, it shall be purged from the system in an approved manner.

17.5 DISINFECTION

17.5.1 The tank structure shall be disinfected at the time of testing by chlorination in accordance with AWWA specification C652-86, or latest revision, "Disinfection of Water Storage Facilities."

17.5.2 Disinfection shall not take place until the tank has been cleaned.

17.5.3 Acceptable forms of Chlorine for disinfection shall be:

- a) Liquid chlorine (section 3.1 AWWA C652-86).
- b) Sodium hypochlorite (section 3.2 AWWA C625-86).

17.5.4 Unacceptable methods of chlorination for disinfection are:

- a) Calcium hypochlorite (HTH brand chlorine.)

17.5.5 Acceptable methods of chlorination per AWWA C652-86:

- a) Section 4.1.1.
- b) Section 4.1.2.1
- c) Section 4.3

17.5.6 Unacceptable methods of chlorination per AWWA C625-86:

- a) Section 4.2.

17.5.7 Waters used for chlorination shall be purged from the system. A neutralizing agent shall be added to the water to prevent chlorination by-products from harming aquatic life.

17.5.8 The tank shall be thoroughly flushed after disinfection.

17.5.9 Following disinfection of the tank, bacteriological samples shall be collected and analyzed in accordance with the requirements of the Kentucky Department for Natural Resources and Environmental Protection. The tank may not be placed into service until samples have been approved.

17.6 - ELECTRICAL/TELEMETRY

17.6.1 General: The CONTRACTOR shall be responsible for obtaining and paying for a power supply to the tank site in the OWNER's name. The installation of all electrical components shall conform to the latest edition of the National Electric Code. All permits necessary for the complete

installation of the electrical system shall be obtained by the CONTRACTOR from authorities governing such work. The costs of all permits shall be borne by the CONTRACTOR.

17.6.2 Service Pole and Telemetry Pole: Fully treated, southern yellow pine.

17.6.3 Service Entrance: Cast Aluminum - 1 phase.

17.6.4 Weatherproof Switch and Meter Socket: Band to pole with rust proof channels.

17.6.5 Wiring: All wiring shall be properly sized for the load as set forth in the latest edition of the National Electrical Code. Provide a minimum of two duplex, grounding type, three (3) wire, polarized convenience receptacles in the valve pit.

17.6.6 Conduit: All conduit shall meet the requirements of the latest edition of the National Electrical Code.

17.7 MEASUREMENT AND PAYMENT

17.7.1 Measurement: There shall be no measurement for payment as the work shall be Lump Sum.

17.7.2 Payment: Payment shall be made at the Lump Sum contract Price for "100,000 Gallon Water Storage Tank Relocation" as set forth in the Bid Schedule. Payment as specified shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the work.

- THE END -

9.3.2.1 Earth Foundation: All pipe shall be laid on a six inch bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #9 crushed stone. Granular bedding shall be mechanically compacted prior to pipe placement.

9.3.2.2 Rock Foundation: If the trench bottom is in rock the excavation shall be undercut to a minimum depth of six inches below the bottom of the pipe. The pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #9 crushed stone. Granular bedding shall be mechanically compacted prior to pipe placement.

9.3.2.3 Special Bedding: In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the ENGINEER may order "Special Pipe Bedding." When the ENGINEER orders "Special Pipe Bedding" (in writing), the CONTRACTOR shall:

- a. overexcavate the mucky subgrade to the depth directed,
- b. install a Type III geotextile as illustrated in the detail drawings,
- c. backfill the geotextile with bedding stone, and
- d. overlap the geotextile envelope in accordance with the detail drawings.

It is to be expressly understood that "Special Pipe Bedding" may only be employed upon written order of the ENGINEER.

9.3.3 Laying Pipe: All pipe shall be laid with ends abutting and true to line and grade as shown on the plans. Supporting of pipe shall be as specified under "Pipe Bedding" hereinbefore and in no case will the supporting of pipes on blocks be permitted.

Fittings for the water mains shall be provided and placed as and where directed by the ENGINEER or shown on the plans. All open ends of pipes and of branches shall be sealed or plugged.

Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Any piece of pipe or fitting which is known to be defective shall not be laid or placed in the lines. Any defective pipe or fitting discovered after the pipe is laid shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

Granular bedding material as specified hereinbefore, shall be used to correct irregularities in the earth trench subgrade.

The interior of the pipe, as the work progresses, shall be clean. When laying of any pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell, so as to exclude earth or other material.

No backfilling (except for securing pipe in place) over pipe will be allowed until the ENGINEER, or his representative has made an inspection of the joints, alignment and grade in the section laid, but such inspection shall not relieve the CONTRACTOR of further liability in case of defective joints, misalignment caused by backfilling and other such deficiencies that are noted later.

9.3.4 Jointing Pipe: The pipe joints described shall be installed in accordance with the manufacturer's recommendations.

9.3.5 Backfilling Pipeline Trenches: All backfilling shall be accomplished in accordance with the details of this section. Any variances must be approved in writing by the ENGINEER.

When directed by the ENGINEER, the CONTRACTOR shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is tamped. The CONTRACTOR shall obtain a compaction of the backfill of at least 95 percent of Standard Proctor Density (ASTM D698) at a moisture content within two (2) percent of optimum.

Before final acceptance, the CONTRACTOR will be required to level off all trenches or to bring the trench up to the level of the surrounding terrain. The CONTRACTOR shall also remove from roadways, rights-of-way and/or private property all excess earth or other materials resulting from construction.

When the pipe trench crosses a street or roadway, the CONTRACTOR shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

In all cases walking or working on the completed pipelines except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a point one foot above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

In all cases the pipe bedding and haunching shall be #9 crushed stone. The pipe bedding shall be mechanically tamped prior to placement of the pipe. The pipe bedding shall be thoroughly compacted taking care not to damage the pipe.

9.3.5.1 Method "A" Backfilling in Open Terrain: Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

In all cases the lower portion of the trench, from the pipe bedding to the springline (centerline) of the pipe shall be backfilled with #9 crushed stone. This stone shall be carefully and thoroughly compacted.

The portion of the trench from the springline of the pipe to a point 6 inches above the pipe shall be backfilled in six inch lifts with #9 crushed stone. Each lift shall be hand tamped taking care not to damage the pipe.

The portion of the trench from a point 6 inches above the top of the pipe to the ground surface shall be backfilled in six (6) inch lifts with material which is free from large rock. Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. The backfill shall be mechanically tamped in six inch lifts to 95 percent of standard Proctor Density (ASTM D-698).

9.3.5.2 Method "B" Backfilling Under Graveled Areas: Backfilling of pipeline trenches under existing and proposed gravelled parking lots, driveways, etc. shall be accomplished in the following manner:

The pipe bedding and haunching shall be placed and compacted as described in Paragraph 9.3.5.1. The lower portion of the trench from the pipe springline to a point 6 inches above the pipe, shall be backfilled and lightly tamped with #9 crushed stone as described in Paragraph 9.3.5.1. The portion of the trench from a point 6 inches above the pipe to a point 6 inches below the ground surface shall then be backfilled with available material in six (6) inch lifts. Each lift shall be compacted to 100 percent of Standard Proctor Density (ASTM D-698) at a moisture content within two percent of optimum. The final 6 inches of the trench backfill shall be thoroughly compacted dense graded aggregate.

9.3.5.3 Method "C" Backfilling Under Paved Areas: Backfilling of pipeline trenches under existing and proposed sidewalks, streets, proposed streets, and driveways shall be accomplished in the following manner:

The pipe bedding and haunching shall be placed and compacted as described in Paragraph 9.3.5.1. The lower portion of the trench from the pipe springline to a point 6 inches above the pipe, shall be backfilled and lightly tamped with #9 crushed stone as described in Paragraph 9.3.5.1. The portion of the trench from a point 6 inches above the pipe to a point 6 inches below the ground surface shall then be backfilled with #9 crushed stone in six inch (6) lifts. Each lift shall be compacted to 100 percent of Standard Proctor Density (ASTM D-698) at a moisture content within two percent of optimum.

The upper portion of the trench from a point six inches below the bottom of the existing or proposed pavement or concrete sub-slab may be backfilled with a base course of dense graded aggregate which shall be maintained flush with the pavement surface for at least 30 days prior to placement of the final surface. The excess dense graded aggregate shall be removed concurrently with the placement of the final pavement surface.

9.3.5.4 Settlement of Trenches: Wherever pipe lines are in, or across, driveways and streets, the CONTRACTOR shall be responsible for any trench settlement which occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the CONTRACTOR. Repair of settlement damage shall meet the approval of the appropriate governing body.

9.3.5.5 Pavement Replacement: Pavement replacement shall be performed in accordance with Section XIV of these Technical Specifications.

9.4 TESTING OF LINES

On all projects involving the installation of water pipeline, the finished work shall comply with the provisions listed below, or similar requirements which will insure equal or better results:

- a) All water mains shall be given a hydrostatic test to 200 psi, under which leakage shall not exceed the limits established in Section 4 of AWWA Standard Specifications C600 (provided in the Reference Specifications of this Contract Document).
- b) All test waters shall be potable water obtained from the Green Hills Water District distribution system. Withdrawals of water from the District system must be both authorized and metered. The District will bill the CONTRACTOR for all waters used in accordance with its current rate schedule.
- c) Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.
- d) Duration of test shall be no less than twenty-four hours.
- e) Where leaks are evident on the surface where joints are covered, the joints shall be recaulked, repoured, bolts retightened or relaid, and leakage minimized regardless of total leakage as shown by test.
- f) All pipe fittings and other materials found to be defective under test shall be removed and replaced.
- g) Lines which fail to meet test requirements shall be repaired and retested as necessary until test requirements are complied with.
- h) The CONTRACTOR shall furnish a recording pressure gauge for the pressure and leakage test. The gauge shall be a Bristol Babcock Model No. 5311110A-143-002-310-610-000. Charts shall become the property of the OWNER at conclusion of test.

9.5 DISINFECTION OF WATER LINES

The new potable water lines shall not be placed in service, either temporarily or permanently, until they have been thoroughly disinfected by the Continuous Feed Method as set forth in the latest edition of AWWA Specification C-651. Specification C-651 is reproduced in the Reference Section of this Contract Document in its entirety.

The following requirements apply to the disinfection activity:

- a) All flushing and test waters shall be potable water obtained from the Green Hills Water District system. Withdrawals of water from the District system must be both authorized and metered. Mountain Water District will bill the CONTRACTOR for all waters used in accordance with its current rate schedule.
- b) The Tablet and Slug Method of disinfection may not be used.
- c) The water lines shall be flushed prior to disinfection. Flush waters may be discharged to the nearest storm drain or surface water way in a controlled manner which will not result in environmental damage.
- d) The CONTRACTOR shall have a chlorine test kit in his possession for purposes of monitoring the disinfection dose.
- e) The free chlorine residual immediately after chlorine dosing shall be 50 mg/l. The free chlorine residual 24 hours after chlorine dosing shall not be less than 25 mg/l.
- f) The waters of disinfection shall be discharged to the nearest Sanitary Sewer (if available). If no Sanitary Sewer is available, the heavily chlorinated waters of disinfection shall be neutralized with an approved neutralizing agent prior to discharge.
- g) After disinfection and flushing, and before the water main is placed in service, bacteriological samples shall be collected and analyzed in accordance with the requirements of the Kentucky Department for Natural Resources and Environmental Protection. The new line may not be connected to the system until the samples have been approved.

9.6 MEASUREMENT AND PAYMENT

9.6.1 Measurement: Water pipe in place, complete, successfully tested and disinfected shall be measured in linear feet along the pipe centerline. Pipe fittings (tees, reducers, etc.) will be measured "each". The length of fittings measured for payment shall be deducted from the lineal feet of pipe laid to avoid "double" payment. Pipe bends will not be measured for separate payment. Bends shall be measured in linear feet. No allowance shall be made for laps or drops at connections.

"Special Pipe Bedding" - ordered in writing by the ENGINEER - in place and accepted shall be measured by the ton of bedding stone actually placed (to the top of the geotextile envelope). There will be no separate measurement of Geotextile Type III or other incidentals.

9.6.2 Payment: Payment for pipe will be made at the contract unit price per linear foot for each pipe class as set forth in the Bid Schedule. Payment for fittings will be made at the contract price "each" as set forth in the Bid Schedule. Such payment for pipe and fittings shall constitute full compensation for all materials, labor, equipment, and incidentals necessary for the completion of the work. Retainer glands for restrained mechanical joint pipe shall be considered incidental to the unit price for mechanical joint pipe.

Payment for "Special Pipe Bedding" - ordered in writing by the ENGINEER - shall be made at the contract unit price per ton for the actual quantity measured. There shall be no separate payment for Geotextile Type III or other incidentals.

- THE END -

American Water Works Association

ANSI/AWWA C600-93

(Revision of ANSI/AWWA C600-87)



AWWA STANDARD
FOR
INSTALLATION OF DUCTILE-IRON WATER
MAINS AND THEIR APPURTENANCES



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AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

SECTION 4: HYDROSTATIC TESTING

WARNING: The testing methods described in this section are specific for water-pressure testing. These procedures should not be applied for air-pressure testing because of the serious safety hazards involved.

Sec. 4.1 Pressure and Leakage Test

4.1.1 Test restrictions.

Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section.

Test pressure shall not exceed pipe or thrust-restraint design pressures.

The hydrostatic test shall be of at least a 2-h duration.

Test pressure shall not vary by more than ± 5 psi (34.5 kPa) for the duration of the test.

Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the

DUCTILE-IRON MAINS AND APPURTENANCES

rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired.

The test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

4.1.2 Pressurization. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing. Each valved section of pipe shall be slowly filled with water, and the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied by means of a pump connected to the pipe. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

4.1.3 Air removal. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place as required by the specifications.

4.1.4 Examination. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until satisfactory results are obtained.

4.1.5 Leakage defined. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi (34.5 kPa) of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

4.1.6 Allowable leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

In inch-pound units,

$$L = \frac{SD\sqrt{P}}{133,200} \quad (\text{Eq 1})$$

Where:

- L = allowable leakage, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the leakage test, in pounds per square inch (gauge)

In metric units,

$$L_m = \frac{SD\sqrt{P}}{715,317} \quad (\text{Eq 2})$$

Where:

- L_m = allowable leakage, in litres per hour
- S = length of pipe tested, in metres
- D = nominal diameter of the pipe, in millimetres
- P = average test pressure during the leakage test, in kPa

These formulas are based on an allowable leakage of 11.65 gpd/mi/in. (1.079 L/day/km/mm) of nominal diameter at a pressure of 150 psi (1034 kPa).

4.1.6.1 Allowable leakage at various pressures is shown in Tables 6A and 6B.

4.1.6.2 When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/h/in. (1.2 mL/h/mm) of nominal valve size shall be allowed.

4.1.6.3 When hydrants are in the test section, the test shall be made against the main valve in the hydrant.

4.1.7 *Acceptance of installation.* Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe discloses leakage greater than that specified in Sec. 4.1.6, repairs or replacements shall be accomplished in accordance with the specifications.

4.1.7.1 All visible leaks are to be repaired regardless of the amount of leakage.

Table 6A Allowable leakage per 1000 ft of pipeline* — $gph \dagger$

| Avg. Test Pressure psi | Nominal Pipe Diameter—in. | | | | | | | | | | | | | | |
|---------------------------|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 30 | 36 | 42 | 48 |
| 450 | 0.48 | 0.64 | 0.95 | 1.27 | 1.59 | 1.91 | 2.23 | 2.55 | 2.87 | 3.18 | 3.82 | 4.78 | 5.73 | 6.69 | 7.84 |
| 400 | 0.45 | 0.60 | 0.90 | 1.20 | 1.50 | 1.80 | 2.10 | 2.40 | 2.70 | 3.00 | 3.60 | 4.50 | 5.41 | 6.31 | 7.21 |
| 350 | 0.42 | 0.56 | 0.84 | 1.12 | 1.40 | 1.69 | 1.97 | 2.25 | 2.53 | 2.81 | 3.37 | 4.21 | 5.06 | 5.90 | 6.74 |
| 300 | 0.39 | 0.52 | 0.78 | 1.04 | 1.30 | 1.56 | 1.82 | 2.08 | 2.34 | 2.60 | 3.12 | 3.90 | 4.68 | 5.46 | 6.24 |
| 275 | 0.37 | 0.50 | 0.75 | 1.00 | 1.24 | 1.49 | 1.74 | 1.99 | 2.24 | 2.49 | 2.99 | 3.73 | 4.48 | 5.23 | 5.98 |
| 250 | 0.36 | 0.47 | 0.71 | 0.95 | 1.19 | 1.42 | 1.66 | 1.90 | 2.14 | 2.37 | 2.85 | 3.56 | 4.27 | 4.99 | 5.70 |
| 225 | 0.34 | 0.45 | 0.68 | 0.90 | 1.13 | 1.35 | 1.58 | 1.80 | 2.03 | 2.25 | 2.70 | 3.38 | 4.05 | 4.73 | 5.41 |
| 200 | 0.32 | 0.43 | 0.64 | 0.85 | 1.06 | 1.28 | 1.48 | 1.70 | 1.91 | 2.12 | 2.55 | 3.19 | 3.82 | 4.46 | 5.09 |
| 175 | 0.30 | 0.40 | 0.59 | 0.80 | 0.99 | 1.19 | 1.39 | 1.59 | 1.79 | 1.98 | 2.38 | 2.98 | 3.58 | 4.17 | 4.77 |
| 150 | 0.28 | 0.37 | 0.55 | 0.74 | 0.92 | 1.10 | 1.29 | 1.47 | 1.66 | 1.84 | 2.21 | 2.76 | 3.31 | 3.86 | 4.41 |
| 125 | 0.25 | 0.34 | 0.50 | 0.67 | 0.84 | 1.01 | 1.18 | 1.34 | 1.51 | 1.68 | 2.01 | 2.52 | 3.02 | 3.53 | 4.03 |
| 100 | 0.23 | 0.30 | 0.45 | 0.60 | 0.75 | 0.90 | 1.05 | 1.20 | 1.35 | 1.50 | 1.80 | 2.25 | 2.70 | 3.15 | 3.60 |

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

†Calculated on the basis of Eq. 1.

 Table 6B Allowable leakage per 300 m of pipeline* — L/ht

| Avg. Test Pressure KPa | Nominal Pipe Diameter—mm | | | | | | | | | | | | | | |
|---------------------------|--------------------------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | 76 | 102 | 152 | 203 | 254 | 305 | 356 | 406 | 457 | 508 | 610 | 762 | 914 | 1067 | 1219 |
| 3000 | 1.84 | 2.30 | 3.45 | 4.59 | 5.74 | 6.89 | 8.04 | 9.19 | 10.34 | 11.49 | 13.78 | 17.23 | 20.67 | 22.97 | 27.57 |
| 2800 | 1.78 | 2.22 | 3.33 | 4.44 | 5.55 | 6.66 | 7.77 | 8.88 | 9.99 | 11.10 | 13.32 | 16.64 | 19.97 | 22.19 | 26.63 |
| 2600 | 1.71 | 2.14 | 3.21 | 4.28 | 5.35 | 6.42 | 7.48 | 8.55 | 9.62 | 10.69 | 12.83 | 16.04 | 19.25 | 21.39 | 25.66 |
| 2400 | 1.64 | 2.05 | 3.08 | 4.11 | 5.14 | 6.16 | 7.19 | 8.22 | 9.25 | 10.27 | 12.33 | 15.41 | 18.49 | 20.55 | 24.66 |
| 2200 | 1.57 | 1.97 | 2.95 | 3.93 | 4.92 | 5.90 | 6.88 | 7.87 | 8.85 | 9.84 | 11.80 | 14.75 | 17.70 | 19.67 | 23.61 |
| 2000 | 1.50 | 1.88 | 2.81 | 3.75 | 4.69 | 5.63 | 6.56 | 7.50 | 8.44 | 9.38 | 11.25 | 14.07 | 16.88 | 18.76 | 22.51 |
| 1800 | 1.42 | 1.78 | 2.67 | 3.56 | 4.45 | 5.34 | 6.23 | 7.12 | 8.01 | 8.90 | 10.68 | 13.35 | 16.01 | 17.79 | 21.35 |
| 1600 | 1.34 | 1.68 | 2.52 | 3.36 | 4.19 | 5.03 | 5.87 | 6.71 | 7.55 | 8.39 | 10.07 | 12.58 | 15.10 | 16.78 | 20.13 |
| 1400 | 1.26 | 1.57 | 2.35 | 3.14 | 3.92 | 4.71 | 5.49 | 6.28 | 7.06 | 7.85 | 9.42 | 11.77 | 14.12 | 15.69 | 18.83 |
| 1200 | 1.16 | 1.45 | 2.18 | 2.91 | 3.63 | 4.36 | 5.08 | 5.81 | 6.54 | 7.26 | 8.72 | 10.90 | 13.08 | 14.53 | 17.43 |
| 1000 | 1.06 | 1.33 | 1.99 | 2.65 | 3.32 | 3.98 | 4.64 | 5.30 | 5.97 | 6.63 | 7.96 | 9.95 | 11.94 | 13.26 | 15.91 |
| 800 | 0.95 | 1.19 | 1.78 | 2.37 | 2.97 | 3.56 | 4.15 | 4.74 | 5.34 | 5.93 | 7.12 | 8.90 | 10.68 | 11.86 | 14.23 |
| 600 | 0.82 | 1.03 | 1.54 | 2.05 | 2.57 | 3.08 | 3.60 | 4.11 | 4.62 | 5.14 | 6.16 | 7.70 | 9.25 | 10.27 | 12.33 |

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

†Calculated on the basis of Eq. 2.

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ANSI/AWWA C651-92
(Revision of ANSI/AWWA C651-86)



AWWA STANDARD
FOR
DISINFECTING WATER MAINS



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AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

American Water Works Association



ANSI/AWWA C651-92
(Revision of ANSI/AWWA C651-86)

AWWA STANDARD FOR DISINFECTING WATER MAINS

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard presents essential procedures for disinfecting new and repaired water mains. All new water mains shall be disinfected before they are placed in service. All water mains taken out of service for inspection, repair, or other activities that might lead to contamination of water shall be disinfected before they are returned to service.

Sec. 1.2 References

This standard references the following documents. The latest current edition of each forms a part of this standard where and to the extent specified herein. In case of any conflict, the requirements of this standard shall prevail.

ANSI/AWWA B300—Standard for Hypochlorites.

ANSI/AWWA B301—Standard for Liquid Chlorine.

Simplified Procedures for Water Examination. AWWA Manual M12. AWWA, Denver (1978).

Standard Methods for the Examination of Water and Wastewater. APHA,† AWWA, and WEF.‡ Washington, D.C. (18th ed., 1992).

Additional materials relating to activity under this standard include the following:

Chlorine Manual—Chlorine Institute Inc.§

Introduction to Water Treatment. WSO Series, Vol. 2. AWWA, Denver (1984).

*American National Standards Institute Inc., 11 W. 42nd St., New York, NY 10036.

†American Public Health Association, 1015 15th St. N.W., Washington, DC 20005.

‡Water Environment Federation, 601 Wythe St., Alexandria, VA 22314.

§Chlorine Institute Inc., 2001 L St. N.W., Washington, DC 20036.

SECTION 3: BASIC DISINFECTION PROCEDURE

The basic disinfection procedure consists of

1. Preventing contaminating materials from entering the water main during storage, construction, or repair.
2. Removing, by flushing or other means, those materials that may have entered the water main.
3. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
4. Protecting the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures.
5. Determining the bacteriological quality by laboratory test after disinfection.
6. Final connection of the approved new water main to the active distribution system.

SECTION 4: PREVENTIVE AND CORRECTIVE MEASURES DURING CONSTRUCTION

Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is, therefore, essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination. Also, any connection of new water main to the active distribution system prior to receipt of satisfactory bacteriological samples may constitute a cross-connection. Therefore, the new main must be isolated until bacteriological tests described in Sec. 7 of this standard are satisfactorily completed.

Sec. 4.1 Keeping Pipe Clean and Dry

Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when it is determined that watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.

Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the lower the risk of contamination.

Sec. 4.2 Joints

Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

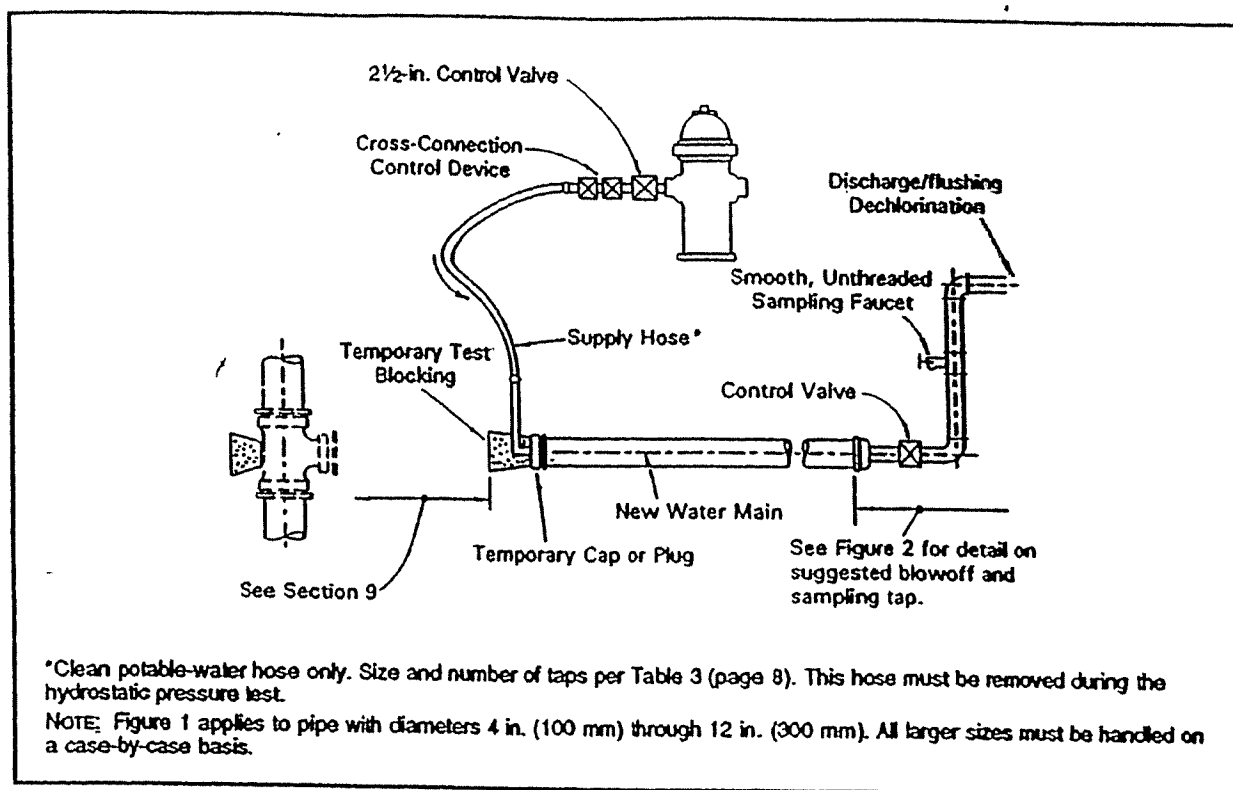


Figure 1 Suggested temporary flushing/testing connection

disinfectant water flushed out. Water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection between the distribution system and the new main. The temporary connection shall include an appropriate cross-connection control device consistent with the degree of hazard, and shall be disconnected (physically separated) from the new main during the hydrostatic pressure test. It will be necessary to reestablish the temporary connection after completion of the hydrostatic pressure test to flush out the disinfectant water prior to final connection of the new main to the distribution system.

SECTION 5: METHODS OF CHLORINATION

Three methods of chlorination are explained in this section: tablet, continuous feed, and slug. Information in the foreword will be helpful in determining the method to be used. The tablet method gives an average chlorine dose of approximately 25 mg/L; the continuous-feed method gives a 24-h chlorine residual of not less than 10 mg/L; and the slug method gives a 3-h exposure of not less than 50 mg/L free chlorine.

Table 2 Number of 5-g calcium hypochlorite tablets required for dose of 25 mg/L*

| Pipe Diameter in. (mm) | Length of Pipe Section, ft (m) | | | | |
|--|--------------------------------|----------|----------|----------|-----------|
| | 13 (4.0) or less | 18 (5.5) | 20 (6.1) | 30 (9.1) | 40 (12.2) |
| Number of 5-g Calcium Hypochlorite Tablets | | | | | |
| 4 (100) | 1 | 1 | 1 | 1 | 1 |
| 6 (150) | 1 | 1 | 1 | 2 | 2 |
| 8 (200) | 1 | 2 | 2 | 3 | 4 |
| 10 (250) | 2 | 3 | 3 | 4 | 5 |
| 12 (300) | 3 | 4 | 4 | 6 | 7 |
| 16 (400) | 4 | 6 | 7 | 10 | 13 |

*Based on 3.25-g available chlorine per tablet; any portion of tablet rounded to next higher integer.

velocity no greater than 1 ft/s (0.3 m/s). Precautions shall be taken to ensure that air pockets are eliminated. This water shall remain in the pipe for at least 24 h. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 h. As an optional procedure (if specified by the purchaser), water used to fill the new main shall be supplied through a temporary connection that shall include an appropriate cross-connection control device, consistent with the degree of hazard, for backflow protection of the active distribution system (see Figure 1).

Sec. 5.2 Continuous-Feed Method

The continuous-feed method consists of placing calcium hypochlorite granules in the main during construction (optional), completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water. The potable water shall be chlorinated so that after a 24-h holding period in the main there will be a free chlorine residual of not less than 10 mg/L.

5.2.1 Placing of calcium hypochlorite granules. At the option of the purchaser, calcium hypochlorite granules shall be placed in pipe sections as specified in Sec. 5.1.1. The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water that flows down the main. In particular, this procedure is recommended when the type of pipe is such that this first flow of water will flow into annular spaces at pipe joints.

5.2.2 Preliminary flushing. Before being chlorinated, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates. The flushing velocity in the main shall not be less than 2.5 ft/s (0.76 m/s) unless the purchaser (or purchaser's representative) determines that conditions do not permit the required flow to be discharged to waste. Table 3 shows the rates of flow required to produce a velocity of 2.5 ft/s (0.76 m/s) in commonly used sizes of pipe. Note that flushing is no substitute for preventive measures during construction. Certain contaminants, such as caked deposits, resist flushing at any feasible velocity.

For 24-in. (600-mm) or larger diameter mains, an acceptable alternative to flushing is to broom-sweep the main, carefully removing all sweepings prior to chlorinating the main.

pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

Sec. 5.3 Slug Method

The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/L. The slow rate of flow ensures that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 h.

5.3.1 *Placing calcium hypochlorite granules.* Same as Sec. 5.2.1.

5.3.2 *Preliminary flushing.* Same as Sec. 5.2.2.

5.3.3 *Chlorinating the main.*

1. Same as Sec. 5.2.3(1).

2. At a point not more than 10 ft (3 m) downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. To ensure that this concentration is achieved, the chlorine concentration should be measured at regular intervals. The chlorine shall be applied continuously and for a sufficient period to develop a solid column, or "slug," of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 h.

3. The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L, the flow shall be stopped, chlorination equipment shall be relocated at the head of the slug, and, as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.

4. As the chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

SECTION 6: FINAL FLUSHING

Sec. 6.1 Clearing the Main of Heavily Chlorinated Water

After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or is acceptable for domestic use.

Sec. 6.2 Disposing of Heavily Chlorinated Water

The environment into which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. (See appendix B for neutralizing chemicals.) Where necessary, federal, state, provincial, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

SECTION 7: BACTERIOLOGICAL TESTS

Sec. 7.1 Standard Conditions

After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 h apart, shall be collected from the new main. At least one set of samples shall be collected from every 1200 ft (366 m) of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater*, and shall show the absence of coliform organisms. A standard heterotrophic plate count may be required at the option of the purchaser (or purchaser's representative).

Sec. 7.2 Special Conditions

If trench water has entered the new main during construction or, if in the opinion of the purchaser (or purchaser's representative), excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft (61 m) and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 16 h after final flushing has been completed.

Sec. 7.3 Sampling Procedure

Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by *Standard Methods for the Examination of Water and Wastewater*. No hose or fire hydrant shall be used in the collection of samples. A suggested combination blowoff and sampling tap useful for mains up to and including 8-in. (200-mm) diameter is shown in Figure 2. A corporation cock may be installed in the main with a copper-tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

SECTION 8: REDISINFECTION

If the initial disinfection fails to produce satisfactory bacteriological results, the new main may be reflushed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated by the continuous-feed or slug method of chlorination until satisfactory results are obtained.

NOTE: High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to sample water entering the new main.

SECTION 9: FINAL CONNECTIONS TO EXISTING MAINS (OPTIONAL)*

As an optional procedure (if specified by the purchaser), water mains and appurtenances must be completely installed, flushed, disinfected, and satisfactory

*Optional Sec. 9 is not included as part of the standard unless specifically identified in the purchaser's specifications.

the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

Sec. 10.4 Slug Chlorination

When practical, in addition to the procedures above, the section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Sec. 5.3, except that the dose may be increased to as much as 300 mg/L and the contact time reduced to as little as 15 min. After chlorination, flushing shall be resumed and continued until discolored water is eliminated, and the water is free of noticeable chlorine odor.

Sec. 10.5 Sampling

Bacteriological samples shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is unknown, then samples shall be taken on each side of the main break. If positive bacteriological samples are recorded, then the situation shall be evaluated by the purchaser (or purchaser's representative) who can determine corrective action, and daily sampling shall be continued until two consecutive negative samples are recorded.

SECTION 11: SPECIAL PROCEDURE FOR CAULKED TAPPING SLEEVES

Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder.

Tapping sleeves are used to avoid shutting down the main to be tapped. After the tap is made, it is impossible to disinfect the annulus without shutting down the main and removing the sleeve. The space between the tapping sleeve and the tapped pipe is normally $\frac{1}{2}$ in. (13 mm), more or less, so that as little as 100 mg/ft² of calcium hypochlorite powder will provide a chlorine concentration of over 50 mg/L.

APPENDIX B

Disposal of Heavily Chlorinated Water

This appendix is for information only and is not a part of AWWA C651.

1. Check with the local sewer department for conditions of disposal to sanitary sewer.
2. Chlorine residual of water being disposed will be neutralized by treating with one of the chemicals listed in Table B.1.

Table B.1 Amounts of chemicals required to neutralize various residual chlorine concentrations in 100,000 gal (378.5 m³) of water

| Residual Chlorine Concentration mg/L | Chemical Required | | | | | | | |
|---|---|---------|--|---------|---|---------|---|---------|
| | Sulfur Dioxide (SO ₂) | | Sodium Bisulfite (NaHSO ₃) | | Sodium Sulfite (Na ₂ SO ₃) | | Sodium Thiosulfate (Na ₂ S ₂ O ₃ ·5H ₂ O) | |
| | lb | (kg) | lb | (kg) | lb | (kg) | lb | (kg) |
| 1 | 0.8 | (.36) | 1.2 | (.54) | 1.4 | (.64) | 1.2 | (.54) |
| 2 | 1.7 | (.77) | 2.5 | (1.13) | 2.9 | (1.32) | 2.4 | (1.09) |
| 10 | 8.3 | (3.76) | 12.5 | (5.67) | 14.6 | (6.62) | 12.0 | (5.44) |
| 50 | 41.7 | (18.91) | 62.6 | (28.39) | 73.0 | (33.11) | 60.0 | (27.22) |